

solplan review

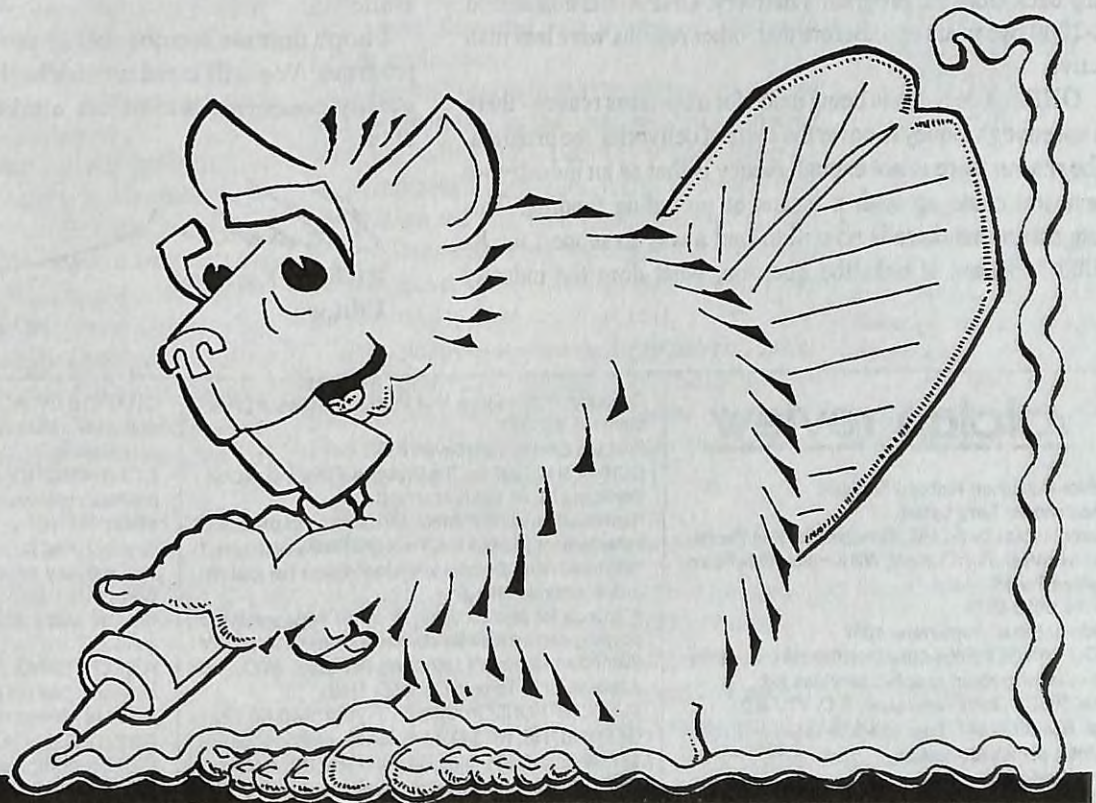
the independent journal of energy conservation, building science & construction practice

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Air Sealing



From the Editor . . .

The housing industry, unlike most other industrial sectors, has many small players. There are no vertically integrated corporations able to undertake innovations and take them into the market. Changes and advances are usually done in a piecemeal fashion on individual elements, often with little regard to the impact a given product or technology will have on the building as a whole.

Yet if we have learned something in Canada, it is that the house is a system, greater than the sum of its parts. Much of this is the result of work sponsored or funded by federal agencies such as CMHC, NRC or NRCan, and to a lesser extent, by provincial governments and sectoral industry associations.

That is why ventures such as the R-2000 Program are important: they offer the opportunity to improve and innovate the product we build. They bring people to the table that otherwise may not talk to each other. It also provides the opportunity to create a brand name with a degree of credibility, so that the consumer can have a level of confidence in the product, making it more than just a marketer's slogan of the month.

These thoughts are brought on by the news that the Ontario Home Builders Association will be ending the delivery of the R-2000 Program. OHBA is not the first provincial organization to step back from the program's delivery. CHBA-BC abandoned R-2000 two years ago. Before that, other regions were less than active.

OHBA's decision is being made for a business reason - there is not enough money to cover the costs of delivering the program. The reason there is not enough money is that as an industry we have not come up with a means of providing funding. This suggests to me there is no will to find a way to support the R-2000 Program. It begs the question, what does the industry

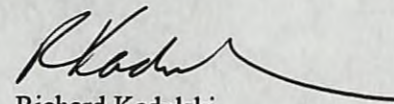
consider it important? Is what was offered by R-2000 too broad a scope, too technical or too complex to understand? R-2000 itself may not be the ultimate program, but there is no other program builders can subscribe to that I am aware of, that addresses technical and quality issues, for the house as a whole system.

The R-2000 Program was initiated in the late 1970's as a response to the need to implement energy efficiency improvements in the building sector. It approached the technical requirements from the point of view of a house as a system. Much of the knowledge gained because of activity initiated by R-2000 has filtered down to improve the performance of the average market house. Now that energy seems not to be an issue, do we simply ignore it, although the consumer benefits are much more than just energy related?

Perhaps, except for a small number of custom builders, this industry has forgotten its roots and lost its pride of craftsmanship and technical improvement.

The lasting contribution the R-2000 Program has made is to upgrade the home building industry's professionalism, through builder training and technical support activities. The ongoing monitoring has provided valuable feedback on the performance of housing systems - to a level of detail not previously available.

I hope that we are not seeing the beginning of the end of the program. We still need a vehicle that addresses technical and quality concerns, and offers marketing and educational benefits.



Richard Kadulski
Editor

solplan review

Editor-Publisher: Richard Kadulski
Illustrations: Terry Lyster
Contributors: David Hill, Duncan Hill, Ken Farrish, John Broniek, Rob Dumont, Will Koroluk, Rick Fearn, Patrice Tardiff
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Tel: 604-689-1841 Fax: 604-689-1841
e-mail: solplan@direct.ca
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Air Sealing

Not long ago, air sealing of existing homes only consisted of weatherstripping doors and windows, and perhaps caulking cracks in interior trim. However, now many other opportunities exist for improving air tightness. Blower doors make it relatively easy to monitor results in the field, allowing refinements in technique and assurance of results.

Why bother air sealing?

The goals and benefits of air sealing go beyond reducing heating costs and increasing comfort. The tightness and ventilation of houses affects indoor air quality.

There are few, if any, areas of residential construction that are so commonly misunderstood as air movement within and through houses. While some old time contractors swear that houses "need to breathe" and refuse to try to make the envelope airtight, others are proud of their efforts to reduce uncontrolled air flow, but remain unconvinced that controlled ventilation is needed in tight houses.

Escaping air carries moisture into attics or other areas where it can condense and cause damage to building materials. Incoming air can bring pollutants, especially those associated with soil gas, into the house. It is the airtight houses without ventilation systems that have generated the attention and stories about unhealthy environments.

While old leaky houses are usually uncomfortable and expensive to heat, new houses are hardly immune to problems associated with air flow. Newer tight homes often tend to have moisture and indoor air quality problems, and may occasionally kill their occupants with flue gasses, which is why the National Building Code has adopted the CSA standard for residential mechanical ventilation. Mechanical ventilation in some form is necessary in any reasonably tight house and beneficial in loose ones.

However, it is important to remember that pollutant source strength is still the most important determinant of indoor air quality. Natural ventilation is not enough to remove common sources of pollutants.

Where to air seal?

The best areas for significant reductions in overall leakage tend to be at the top and bottom of the house. These are areas that experience maxi-

mum stack action pressures from heavy cold air sinking and warm air rising. They are also areas that tend to cause problems other than heat loss. Leaks at the top of the building, because the air is usually going out, are often sources of condensation problems. Leaks at the bottom can carry moisture, radon, or whatever else is in the soil gas, into the house.

High humidity areas such as bathrooms deserve special attention. Bathroom exhaust fans often deliver air into the attic rather than outdoors because improperly placed exhausts and leaky ducts.

Standard recessed lights are a real headache for achieving air tightness. They are designed to be cooled by air movement, so they must have enough space maintained around the fixture.

Above-grade holes in the basement walls include penetrations for utilities, gaps at the top of the foundation walls or sill plate, or perhaps windows in disrepair.

Hard to get to areas, such as in attics or shallow crawl spaces, need to be carefully looked at. The unpleasantness of dirty, cramped spaces is one reason major leaks are likely to be found there; it is a sure bet that whoever last worked in those areas was more concerned with getting out than with being meticulous.

Kneewall spaces in split levels and attic spaces are troublesome, as they are directly connected with the ceiling of the floor below and adjacent.

Fireplaces are big holes. Warm air usually goes up and out the flue, so the cold draft is felt elsewhere. Dampers are often left open, and even when closed, are very leaky. Glass doors can work, if they are reasonably tight (most are not).

Fire stopping around the fireplace and chimney is not always installed, so especially in older homes, there will often be a second "chimney" around the fireplace, to maintain the required clearance to combustible materials.

Housing stock varies widely. Even within a given geographical area, surprising variations in the way buildings are put together can be found. Fortunately, the laws of physics are reliable



Need another reason for air sealing? It's a good way to keep unwanted intruders out. Ever wonder how so many flies, spiders, and other fauna get inside? They find all those leakage paths!

Your editor found a wasp's nest growing merrily inside his house!

The criteria for selecting an air sealing material are straightforward.

- ☛ Firstly, it needs to actually stop air.
- ☛ Secondly, it needs to be relatively permanent (ideally, good for the life of the building).
- ☛ Thirdly, it should be environmentally friendly and have low emission characteristics.

and useful tools that, once understood, can be widely applied.

When air sealing an older house, seal the biggest holes first, then progressively work to the smallest.

Forced air systems can have a large effect on the overall leakage of the house. They can contribute to moisture, comfort, and safety problems. Sealing ducts to make them airtight can significantly improve the efficiency of forced air systems. Unbalanced systems that deliver air to one part of the building while returning it from another can create quite powerful pressure differences, both between building sections and between indoors and outdoors. Examples of this include single-return systems that deliver air to bedrooms with closed doors, pressurizing these rooms while de-

pressurizing the central part of the house and furnaces in the basement that have loose return systems in the basement.

If the air is stopped at the easiest spot to get at, perhaps it need not be stopped elsewhere. Often, sealing holes in the attic floor will stop leaks through interior partitions or plumbing chases, eliminating the need to caulk cracks in the living space. Dense-packing walls will prevent baseboard and trim cracks from leaking.

Blower door testing during caulking and air sealing work can be used to find out the effectiveness of the work being done. Periodic measurements during the work can show whether the sealing done since the last measurement was worthwhile. ☼

How Tight is Too Tight?

Energy retrofit techniques have improved greatly in recent years, especially regarding air sealing of houses. Diagnostic tools, such as blower doors, have vastly improved our ability to measure and control air flows in buildings. At the same time, there is still a concern that at times we may be going too far. We read in the newspapers of carbon monoxide poisonings. We learn of indoor air hazards like formaldehyde, volatile organic compounds and radon. We see tight houses with water running down the windows, mold growing on the walls. The medical fraternity is attributing the increased occurrence of respiratory problems to airtight houses.

There is no doubt that a well-sealed house can create unhealthy or dangerous situations. We live in houses full of known and unknown health hazards. Every piece of furniture and clothing, every household cleaning and personal hygiene product is a hazard. We also generate our own air pollutants through normal metabolic action. We heat houses with appliances designed for an essentially unrestricted supply of air. If we don't have

enough fresh air in these buildings, we will have problems, so we also must consider effective ventilation strategies when planning for air sealing.

Estimating the natural leakage is

tricky. You cannot use a blower door to assess natural ventilation rates. Blower doors don't measure natural infiltration, but tell us the total leakage path area. The air change is based on how big the holes are and the pressure difference across those holes.

Air leakage depends on the pressure differentials due to three forces: the stack effect, wind, and mechanical equipment. The stack effect is going to be influenced by the distribution of openings in a particular building. The neutral pressure plane (the plane at which there is a balance between positive and negative pressures) in a house will fluctuate depending on the size and location of openings.

The positive pressure areas are normally in the upper part of the building, so any holes in this zone will be places of outward leakage of warm moist air. These can be at light fixtures (especially recessed pot lights), plumbing vent stacks and chimneys.

The negative pressure zones draw in exterior air, and so become the source of cold drafts.

Wind direction changes regularly; it is completely random. Mechanical equipment affects air flows and pressure distribution within a house since a forced air system has a major pressure influence in the building, you can't treat a building with a forced air system in the same way as one with a radiant system.

One of the most effective ways for air sealing to affect indoor air quality, even with substantial air tightening, is by removing sources of indoor pollu-

Pollutant Sources

Unvented space heaters can have serious health consequences. Soil gas can carry massive quantities of pollutants into the house. Furnaces can backdraft themselves. Smokers are a health hazard to their housemates. Irresponsible use of pesticides or chemicals can harm those around them. *All of this is true for both tight and loose houses.*

tion. If the sources remain unchanged, and the building is sealed up, any problems will be made worse.

The biggest and most significant pollutant source happens to be combustion products. The major concern is carbon monoxide, a byproduct of incomplete combustion. If you only get one thing right, make it combustion safety.

Combustion safety includes many things, but from the point of view of air sealing, it is a matter of being reasonably sure that products of combustion consistently end up outside. When fans (exhaust fans, central vacuums, downdraft range, clothes dryers, furnace fans) pull air out of a space, replacement air has to come from somewhere. In many houses, the largest hole is the chimney. The draft up the chimney is weak, so when the house is put at a negative pressure (for example from a high power fan on a downdraft cooktop) the chimney can become an air inlet, thus drawing any combustion gases into the house.

When a house is being sealed, combustion safety tests must always be done. The best ap-

proach is to create a worst-case scenario and monitor the results. If necessary, combustion air must be added.

Once the major pollutants are eliminated and the combustion equipment is safe, there are still people in the house who need a good source of fresh air - which is why mechanical ventilation must be added.

How tight is too tight so you won't have any indoor air quality problems? Every house in North America is too tight. You have to be outdoors. Indoor air quality does not depend entirely, or even primarily, on air-tightness. The control of indoor air quality should include more information than just the tightness of the building. Some preexisting conditions are much more important than the blower door measurement.

Anyone depending upon natural infiltration for ventilation needs to understand the limitations of that approach, both in terms of the accuracy of the estimate and also regarding the behaviour of the uncontrolled, irregular, potentially damaging air flow we call "natural." ☼

Log House Air Tightness

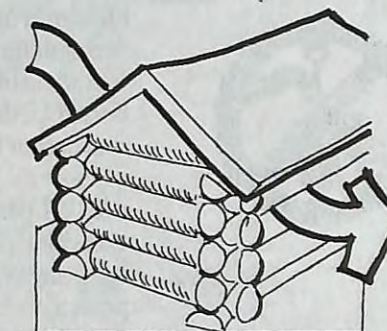
What was found?

Building log homes that are quite air tight is possible as good levels of air tightness were observed for each of three types of log walls. In homes where special attention was paid to the air sealing details, it was possible to achieve an air leakage rate that was less than 2-air changes per hour (ACH) at 50-Pa pressure. Although some homes had low air leakage rates, none of them had exhaust fans.

The homes appeared to have a similar range of air tightness results (between 1.8 and 10.7 air changes per hour at 50 Pa pressure) to that found in US studies. The average for the Canadian homes was lower (3.9 ACH compared with 5.3 ACH) than for six log homes tested in Idaho.

Cracks in individual logs were rarely a source of air leakage. Using a smoke pencil, leakage was observed at:

- the corners;
- the transition between log walls



The lowest air leakage rates for each log construction type were:

- round v-scribe: 1.9-ACH
- hewn dovetail corners: 1.9-ACH
- milled: 1.8-ACH

Air sealing the house is a critical first step to an energy efficient house. But what about log houses? We have heard stories told by North American pioneers in about how cold and drafty the houses were in winter. With log construction what you see outside is also what you see inside. There are many possible paths for air to move through the wall. A complicating factor is that there are several different construction approaches: some use highly milled wood, others only limited scribing.

How Airtight can you make log houses?

Very little information exists. A few studies that exist, done largely for the log home industry, generally suggest that it is possible to air seal a log home.

A recent study for CMHC air tightness tested 11 log homes in Eastern Ontario and Western Quebec. The sample represented a range of sizes, ages and construction details. The test procedure followed the standard CGSB air leakage test protocol. However, the work went beyond a "standard" R-2000 air tightness test as air leakage paths through various details were investigated.

and the other building components, such as gable ends and knee walls;

- around doors and windows; and
- wall penetrations, such as floor joists and electrical receptacles.

Where higher leakage rates were detected, the leakage was not through the log walls themselves; rather, other parts of the building construction contributed to air leakage, such as:

- header spaces that were either completely uninsulated or stuffed with glass fibre insulation but no air barrier;
- at ceiling and roof penetrations;
- at basement wall penetrations.

Sealing (chinking) the exposed face of the log joints increased air tightness much more than a double line of caulking between logs. The same was generally true for air sealing of joints at window and door openings. Resealing is necessary as settlement occurs over time.

The face sealing of the joints can be visually inspected after they are installed. Unlike sealants within wall cavities, quality control is not time

dependent and not affected by the weather at the time of construction. Sealing can be corrected where necessary after construction is completed, and be redone during and after settlement.

Two seals or barriers to air movement, such as two strips of butyl or a double bead of sealant, appeared to be much more effective than a single one. The air tightness of round V-scribe and hand hewn logs was tighter than expected indicating that craftsmanship is a factor in achieving air tightness.

Tightening down gasketed walls with trough bolts can maintain air tightness as shrinkage occurs. Where gasket systems are installed, frequent tightening of through bolts will improve the air sealing, especially in the first few years when settlement is greatest. The home with the highest air leakage test results had not been adequately designed to accommodate settlement.

Various methods of allowing settlement without causing stress on windows had been used, and all appeared to work well. ☼

Air Leakage Performance of 11 Log Houses in Eastern Ontario & Western Quebec by Buchan, Lawton, Parent Ltd., Jools Development, and Drerup Armstrong Ltd. for Canada Mortgage and Housing Corporation.

BC 1 Call



We put many services underground. Often, they are installed at different times. For safety reasons, there may be special design requirements and clearance from other services. These can be a problem for contractors, especially when needing to find them. To reduce the risk of accidents due to buried facilities BC One Call, a proactive damage prevention initiative was established in BC.

Once they receive a call asking location information, all potential agencies are contacted, and the excavator is advised who is being notified. Each company or agency then follows a systematic approach to collect the necessary information and provide the location of buried facilities.

Everyone, from homeowners to major contractors are encouraged to use the service. It saves time and money, reduces risk of accidents, injury, environmental or facility damage and down time, and also improves safety and lowers litigation and compensation costs.

BC One Call is run as a non-profit association. Its members include the owners and operators of buried facilities such as pipelines, utilities, municipalities, fibre optic cable operators. ☼

BC ONE CALL
4585 Canada Way, Suite 218
Burnaby, B.C. V5G 4L6
Tel: (604) 257-1900
Fax: (604) 293-1900
1-800-474-6886

Building Officials Want Respect Too!

What's your image of a building official? The guy who tells you no? The one who harasses you on the job site? The guy who writes out stop work orders because he doesn't like your looks?

There is no doubt we have a love-hate relationship with building officials. Mostly it's hate, because the nature of their job - to be gate keeper and guardian of minimum standards, and we are usually on the receiving end of their reprimands and red cards.

It's no wonder they feel unloved! Of course, professional builders know that building officials are a necessary part of ensuring the public safety.

To stimulate a more positive public view of building officials the Ontario Building Officials' Association (OBOA) has recently embarked on a public relations outreach campaign. The program is being spearheaded by OBOA Director Willy Wong of Hamilton.

Heat Recovery Ventilation Systems Performance Survey Results

Ventilation is one of the most important issues of the '90s in the Canadian construction industry. The need to provide fresh air into houses to ensure the comfort and safety of occupants has been recognized for some time. Building Codes now require that fresh air be provided, to replace stale, contaminated air exhausted outdoors.

Over the past ten years, the use of heat recovery ventilators (HRVs) to meet ventilation needs has grown steadily. Initially they were used mainly in R-2000 homes. All certified R-2000 houses are inspected and ventila-

tion systems are tested by independent inspectors, although equipment must be installed by trained trades. However, what happens when this level of review is not present? Given the increased reliance on HRVs to meet code ventilation requirements, there are serious concerns about the effectiveness of HRV installations. Do the installations meet acceptable standards? Do they really do what they are supposed to do? Are systems functioning properly? Do homeowners know how to maintain the equipment? How did the occupants actually use and maintain their HRV?

A study was done to find out what the present situation is. Sixty homes were inspected in three regions (the west coast, the east coast, and central Canada). All installations were at least one year old, but some were up to fourteen years old. All the installations had HRVs with cross-flow heat recovery cores. Residents were surveyed, and HRV systems were tested.

The number of homes built without forced-air heating systems on the east and west coast is far greater than it is in the central region, so fully ducted HRV installations were more common on the two coasts.

Many ventilation systems in this study were installed during the period when building codes provided limited regulation on the installation and performance of HRV systems. Most of the installations inspected were believed to be typical of current industry practice.

Four types of systems were studied: fully ducted, extended, simplified standard installation and simplified cross furnace.

Fully Ducted

Fully ducted HRV installations are independent of any other air handling equipment. Air is exhausted from service areas (kitchens and bathrooms) and supplied directly to other rooms throughout the house. This is typically done with non-forced warm air heating systems.

Extended

Extended HRV installations exhaust air from the kitchen and bathrooms and supply air into the furnace return. The furnace fan then circulates the ventilation air throughout the house.

Simplified Standard

Simplified standard HRV installations exhaust air from the furnace return air plenum and supply air to the furnace return air plenum (downstream of where air is exhausted). Ventilation air is circulated by the furnace fan.

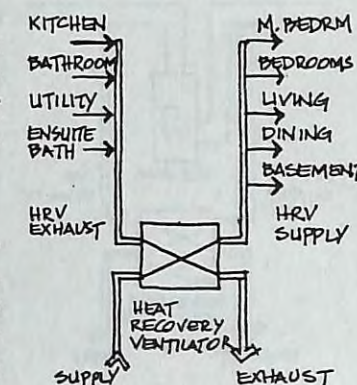
Simplified Cross Furnace

Air is exhausted from and supplied to the furnace ductwork and circulated via the furnace fan. These installations fall into two categories; those that exhaust from the return air plenum and supply into the supply air plenum, and those that exhaust from the furnace supply air plenum and supply to the furnace return air plenum.

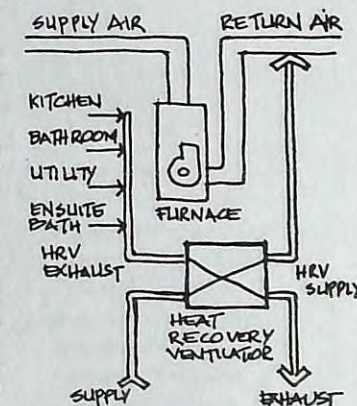
The fully ducted and extended systems are commonly used in R-2000 houses. Simplified systems have now gained a large share of the market in tract-built housing in Central Canada.

The HRV systems studied could perform well. Most were operating and were perceived to be providing a benefit to the occupants of the houses. However, many improvements could be made in installation practice, system performance, occupant understanding and occupant interaction with their system.

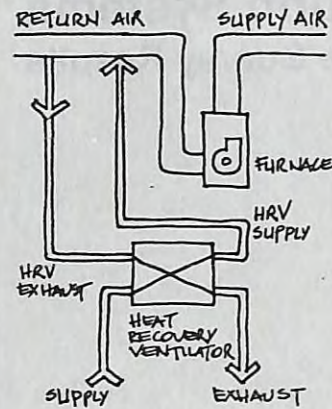
One of the most troubling aspects identified in the study related to the use of HRVs in Central Canada, where simplified systems have taken a large share of the market in tract housing. In Ontario, until the early 1990s, most HRV installations were the extended type. When the simplified systems are compared with other types, the quality of the installations and the occupant use and under-



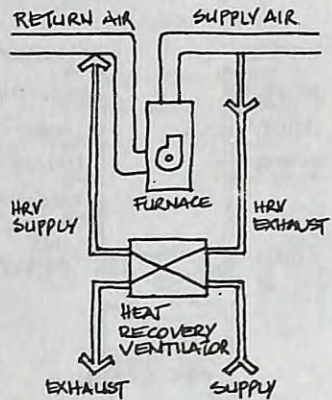
Fully Ducted system schematic



Extended system schematic



Simplified Standard system schematic



Simplified Cross Furnace system schematic

standing of the systems is notably lower.

In the simplified systems:

- HRVs are less likely to be balanced during installation;
- more than 25% of the furnace fans are not equipped with switches to allow them to operate continuously;
- the average occupant understands less about what their HRV was intended to do, how to operate it properly, and what the possible negative effects of misuse;
- the average occupant is more likely to perceive their HRV to be of little value.

Standard installation practice must be improved. This study found that simple and inexpensive measures can dramatically improve the ability of HRV ventilation systems to perform adequately. Information delivery must be improved to encourage the average occupant to use their HRV correctly, maintain it properly, and believe it to be of positive value.

HRV System Observations

Warm-Side Ducts

Flexible ductwork was used in most of the simplified installations inspected. Very little attention seemed to have been given to the design and installation of this ductwork, and inappropriate connection and transition sections were often used.

Cold-Side Ducts

Only half the HRV installations inspected had properly installed cold-side ducts. Common problems included poor sealing of the vapour barrier at connections and the compression of the insulation. In many simplified systems, flexible ducts were compressed between the joist and top plate of the basement wall, thus reducing its effectiveness. In one case, the ducts were so poorly installed, the cold side ducts became unattached from the HRV.

Exterior Vents

A minimum clearance of 6 feet from contaminant sources to the HRV supply port is recommended by the HRAI Manual. A quarter of systems had pollutant sources much closer (most commonly, dryer exhausts, HRV exhausts and gas regulators).

Older HRV installations (more than 4 years old) had galvanized steel or aluminum hoods with hinged screens. Many newer installations have plastic assemblies with snap-in-place grilles in

front of the bird screens. These plastic snap-in-place grilles don't seem to stand up, as many were already broken or missing.

The minimum bird screen mesh size referenced by guidelines is 1/4" (6mm). Most systems had appropriate unblocked screens. Where this was not so, the screens were blocked with debris, or too fine a mesh that restricted air flow. These fine mesh screens had been installed by occupants concerned about insects. In two cases, the bird screens could not be cleaned because they had been placed in inaccessible locations.

Defrost

Due to the mild climate, none of the HRVs inspected in the west coast had a defrost option. In other regions all the extended and fully ducted systems had damper type defrost. However, two-thirds of the simplified HRV installations had electric resistance-type defrost mechanisms on the supply duct.

Of the four defrost mechanisms that were not working when inspected, three were electric resistance type. In one case, failure of the electric resistance defrost caused the core to freeze.

In another simplified system the defrost was not functioning, but the homeowner was not aware of any problem because the warm exhaust air from the furnace supply plenum was defrosting the core!

Filters and Cores

In most cases the filters and core in the HRV unit were installed correctly. However, the filters and cores were clean in less than 50% of the homes inspected (less than 10% for all HRV systems five years old or older).

Non functioning HRV's

7% of the inspected HRV installations were not operational. Supply air fan motors in two of these units had ceased to function. However, as both units had working exhaust air fans, the homeowners could still hear their HRVs running so they were unaware there was a problem.

Occupant Adjustment

The two most common adjustments made by occupants were to install a fine mesh screen on the fresh air intake and blocking or installing a damper on an HRV exhaust vent within a room because they felt it was not needed.

HRV balancing

Only half the installations were found to be balanced within 10% on high speed (29% of the installations were out of balance by more than 40%).

The simplified, cross-furnace installations were the least likely to be balanced. While the HRV's were sized properly, the excessive use of flexible ducting reduced air flow by 30 to 40% from what was expected for the equipment. This also means that many simplified systems were not able to achieve the minimum ventilation capacity.

Humidity Control

Only one third of the HRVs had low speed air flow rate settings that were less than 60% of the high speed air flow setting. This partially explains occupant observations regarding air inside their homes being too dry in winter. A variety of solutions may be worth investigating to reduce the problem of dryness in the winter months.

Potential Health Concerns

In 17% of the houses, the exhaust flow exceeded supply by more than 35%. As a result, unsealed combustion appliances could backdraft into the house. In one of the houses where the motor driving the supply side fan was no longer working the HRV had caused the fireplace to backdraft.

In another house where the HRV core was completely blocked, the homeowner stated the air quality was poor and they had to open the windows in winter.

Occupant Use and Understanding

How well do home owners understand and operate their ventilation system? Only 80% used their HRVs continuously in winter. Reasons why they might not run HRVs continuously included comments that the house was too dry in the winter. However, on the west coast all occupants ran their HRV continuously throughout the year.

Where high-speed timers were provided, most occupants used them.

Another aspect of the study was to cross reference a resident survey with results found during the site inspection.

Of the occupants who said they understood their HRV systems (77%):

- 55% had unbalanced HRV systems
- 60% had substandard ventilation (less than the minimum ventilation capacity specified by CSA F326). However, this does not tell us if the indoor air quality was good or not. In reality, the minimum standard sometimes may still over-ventilate the house, in other cases it may not be enough.

55% of occupants with partially ducted or simplified HRV systems were not aware the furnace fan had to operate continuously.

Of the occupants who reported indoor air quality problems (26%):

- 60% had substandard ventilation
- 62% had unbalanced HRV air flows
- 56% had HRV systems with dirty filters and heat recovery cores.

Of the occupants who reported they performed regular maintenance (81%):

- 42% had dirty filters or cores
- 17% had blocked air intakes
- 46% had unbalanced HRV air flows

Of the occupants who reported having read the HRV operation manuals (32%):

- 34% had dirty filters and cores
- 49% had unbalanced HRV air flows
- 40% operated the HRV systems at recommended ventilation rates

Of the occupants who reported they did not read their HRV manual (68%):

- 47% had dirty filters and cores
- 63% had unbalanced HRV air flows
- 17% operated the HRV systems at recommended ventilation rates.

Effectiveness of the ventilation systems

The apparent air change rate in the rooms of several test homes was determined with and without the ventilation and circulation systems running. It was found that fully ducted, extended and simplified HRV systems can all be effective in delivering fresh outdoor air throughout the house. Natural ventilation alone was not enough to provide adequate ventilation, for most homes.

Homeowners who commented that the mechanical air flow was poor in a given room were proved to be correct, both in terms of air flow measurements and the apparent mechanical air change rates.

For simplified systems, the operation of an HRV without a circulation fan to distribute the fresh air resulted in inadequate fresh air distribution to living areas and over-ventilation of basements. Circulation systems must be in operation to distribute fresh air throughout the house. ☼

Field Survey of Heat Recovery Ventilation Systems
prepared by Buchan, Lawton, Parent Ltd for Research Division Canada Mortgage & Housing Corporation

Buffering Effect of Attached Garages



For information on the R-2000 Program, contact your local program office, or call 1-800-387-2000

An attached garage can be a good buffer against the outdoor conditions. The R-2000 Program has recognized this, and gives a credit of 15% to the R-value of the common elements between the attached garage and the house. This number was determined based on computer modelling of the building.

Last winter, ten R-2000 houses were monitored during December to February to see exactly what the energy impact of attached garages is. The monitoring showed that attached garages provide significant shielding to the house envelope components. The data also showed that as could be expected, the buffering effect was much higher for insulated garages than in the uninsulated garages. Energy savings depends on the degree and level of

attachment of the garage to the house. The higher the percentage attachment of the garage to the house, the greater the value of the buffering ratio, and the higher the energy savings.

In the uninsulated garage the average temperature was about 6°C warmer than the average outdoor temperature. For the insulated garage, the average indoor temperature was about 11°C warmer than the average outdoor temperature.

R-2000 Program Credits

Because of this study, the guidelines for attached garages have been modified. Simplified guidelines have been developed for R-2000 design evaluators to give credit for the effect of attached garages.

This is an element that is not yet modelled by HOT-2000, so a manual calculation has to be done. The adjustment factor applies to the thermal resistance of surfaces common to the house and garage and depends on the proportion of surface area common to the house and garage, as shown in the table. It may seem a complex calculation, but it accurately reflects the performance. ☼

Proportion of Common Elements	Adjustment Factor		
	Uninsulated		Insulated & finished
	Finished	Not Finished	
15%	1.05	1.03	1.08
30%	1.1	1.05	1.16
45%	1.16	1.08	1.24
60%	1.21	1.1	1.32
75%	1.26	1.13	1.4

Calculating the attached garage credit: an example

The take off and calculations are done as normally. Once the R-values for the common elements are available (calculated by HOT-2000), a second hand calculation is done, but the increased R-value is entered manually, rather than having HOT-2000 do the calculation.

The proportion of common elements of the garage to the house is equal to the area of all common surfaces attached to the house divided by the total surface area of the garage.

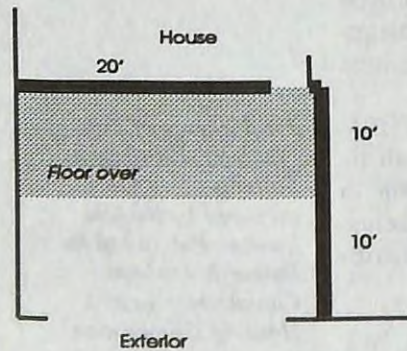
The total surface area includes the common surface areas, the exterior surface area of the garage (walls, windows, doors), the automotive door area and the floor area. The common surfaces include walls, ceiling, and doors between the garage and the house.

For example, assume an insulated, finished 20x20 garage, 8 foot ceilings, with a 10x20 floor area over the garage (see sketch plan).

The total surface area of the garage is 1440 sq.ft. (400 sq.ft. each floor and ceiling, 640 sq.ft. total wall area). The garage has 2 common walls with the house, plus 200 sq.ft. of finished heated floor area over.

The total common area is 520 sq.ft. As a percentage, the total common area is 36%. Thus, the insulation value of the common elements can be increased by 16%. So for example, if the calculated R-value of the common walls is R 16.5, the adjusted R-value that can be used is R 19.14 (16.5x1.16).

If the garage were uninsulated, but finished, the allowable increase would be 10%.



Garage plan used in example

Technical Research Committee News



Carpet Staining Along Walls

This is a problem we have reported about in the past, but it is a problem that is still with us.

What is it? Dark stains along the exterior perimeter of a room that are especially noticeable on light coloured carpets. A major cause is the result of the infiltration of exterior air. The contaminants present in the air effectively get "filtered" out onto the carpet along the walls. This has been a big problem in some areas. It seems that the problem is still with us.

The major solution has been air sealing the structure, to reduce the air infiltration. We would like to know what your experience has been with air tight homes. Has this been seen in R-2000 houses (or similarly airtight houses)? Is carpet staining an issue in these cases? Let us know.

Liability Study

The nature of construction and construction administration is changing. Not only are changes taking place in the technology, but also in the administration of building. Along with an increased level of litigation, the question emerges: who is responsible for what? This is becoming an issue as the role of local authorities having jurisdiction in the compliance process is changing.

If the building inspector insists on other professionals to provide certification, what is the role of the building inspector? These are the type of issues that are being investigated in a study that is being undertaken by CMHC, IRC and CHBA.

National Building Code Processes

Building codes and standards are something we can't avoid dealing with. Few like the heavy hand of regulations, yet there is a need to provide a level base. CHBA has invested considerable energy in the code development process. It participates actively in the strategic planning process, providing input to the code development process, contributing to the model energy codes, proposed housing code, etc.

CHBA will be following the work of the Canadian Commission on Building and Fire Codes (or CCBFC - the technical body that develops the codes) and the Provincial-Territorial Committee on Building Standards (the political/administrative body that decides code developments) that will be examining the current process for code development which includes duplication at the provincial

level. CHBA would like to see active, meaningful provincial involvement in the national code consultation process. This should avoid the duplication of effort, and reduce the differences in codes between different jurisdictions.

Model National Energy Code for Houses

In response to concerns raised by CHBA and others, the CCBFC has renamed this document as a "model" code. They are not recommending the code, but treating it as a technical rather than a regulatory document. The Commission does not have a position on energy, as this is a provincial policy issue.

Attached Garage Emissions Study

In a cold climate, there is a logic to the added comfort and convenience that an attached garage provides. They are a design feature standard in most new houses built today. However, what the garage is built for - to store vehicles, is also a potential health hazard. The indoor air quality in the house may be adversely affected.

Infiltration of vehicle emissions from garages has been identified as a problem for chemically sensitive people. Still, how wide spread the problem may be, or how significant is not well documented. Studies in the United States have shown that garages are a major source of carbon monoxide inside the house. This is especially the case when the vehicle is starting. Gasoline emissions are another group of volatile organic compounds (VOCs) that can contaminate houses. Vehicle tailpipe emissions are highest in the first three minutes after a cold start.

To get data on which health hazards and risk evaluations can be made, a study sponsored by Health Canada will be testing some homes during the winter. It will measure emissions from a vehicle used daily, measure how much of the gas enters the house, and how quickly the concentrations decrease. Study results will show if changes should be considered into the way we build garages. Winter was chosen as it is the most severe case for emissions, and the stack effect of houses is greatest, creating conditions to draw the maximum air volumes into the house.

The Technical Research Committee (TRC) is the industry's forum for the exchange of information on research and development in the housing sector.

Canadian Home Builders' Association,
Suite 200, 150 Laurier Ave. West, Ottawa, Ont. K1P 5J4
Tel: (613) 230-3060
Fax: (613) 232-8214
e-mail: chba@chba.ca
http://www.chba.ca

Fire Research Data Finds Its Way Into Building Codes

By Will Koroluk

Public demand for quieter residential environments has sparked research at the National Research Council's Institute for Research in Construction into sound ratings of floor assemblies. This demand has created, however, some problems with the fire resistance of these same assemblies.

When completed late this year, data gathered during the project will be available to design professionals faced with satisfying both the acoustical and fire-safety requirements of their provincial building code.

As the demand for acoustic isolation has increased, that demand has been reflected in the National Building Code, the model that forms the basis for most provincial codes. These codes refer to sound transmission classifications and assign numbers to them. Thus, the STC 50 required in the 1995 National Building Code as the minimum sound isolation in multi-family dwellings means less sound transmission than the STC 45 minimum specified in the 1990 code. The problem with this is that to achieve STC 50, some changes are needed in the way a building is constructed. Some of those changes negated the existing fire ratings for the assemblies.

Dr. Mohamed Sultan, a researcher at the IRC's National Fire Laboratory, has said that the changes make existing collections of data on sound ratings and fire resistance of floor assemblies obsolete. So he and Dr. Alf Warnock, of the IRC's Acoustics Laboratory, are heading a team to measure fire and sound ratings of floor assemblies. Specifically, they are examining concrete slab, steel joist construction, wood-joist, wood-I-joist and wood-truss floors. This concurrent fire-acoustics testing is the first such program on this scale ever undertaken in North America.

When the work is completed late this year, the results will be made available to the appropriate code committee to update the sound and fire-resistance ratings in the appendices of the National Building Code. Although no decision has yet been made, it is possible that the data will be published as a revision to the 1995 Code.

Thus, research work, much of it done by using computer modelling, will find its way by way of the design professional into everyday application in the field.

Something similar has already happened with wall assemblies. That project involved 22 full-

scale fire tests, 49 others on a smaller scale, and more than 200 sound tests. The results formed the basis of sound and fire-resistance ratings for more than 160 wall assemblies published as part of an appendix to the 1995 Code as "deemed to satisfy" code requirements.

Code users will have noticed that the tables that used to occupy just two or three pages now occupy about two dozen. A similar expansion in the tables dealing with floor assemblies will take place when those results are published.

In many respects, the work is typical of the work the Fire Lab has been conducting since its formation in 1953.

IRC was established by the National Research Council as the Division of Building Research in 1947, with the mandate to provide a research service to Canada's construction industry. This year it is celebrating its 50th anniversary. Part of its original mandate was to lead industry in the revision of the first National Building Code, published in 1941, and to provide research and technical support to the national housing agency then known as Central Mortgage and Housing Corporation, which had been formed in 1946.

The new division grew quickly and within five years a fire research group was formed. Ken Richardson, the current director of the IRC Fire Lab, said data collected from the first large project carried out by the fire lab in the 1950's found their way into the National Building Code, and are still there.

In 1958, construction of the St. Lawrence seaway was nearing completion. When it was finished, and the water began to rise, about 22,000 acres of land, and six villages along the Canadian shore would be flooded. Many buildings were moved to higher ground, but some buildings were to remain in what now are referred to as the Lost Villages. So Fire Lab scientists got permission to install instrumentation in some of the houses, then burned them down to obtain data. From those experiments, known as the "St. Lawrence burns," Mr. Richardson said "scientists were able to quantify for the first time the impact of fire in one building on an adjacent structure."

"That information eventually made its way into the National Building Code and was the basis for the Part 3 tables on spatial separation. Exterior systems and materials have changed," Mr. Richardson noted, "but those tables are still in use. Now, though, with the advent of new materials and

systems, moving buildings closer together may be possible and still make them safe, so we are just now beginning to open that question again."

Back in the 1950's, lath and plaster walls were still the rule, although people were beginning to wonder about gypsum board and what it could do. Much of the early evaluation of that material was done at the fire lab, and found its way back to manufacturers and into codes. Similarly, lab scientists were instrumental in finding ways to evaluate the fire-resistance of concrete blocks, then corroborate those evaluations through full-scale testing.

The lab's role has not primarily been one of developing new products or systems, Mr. Richardson said, "but one of working with industries which were developing products to help them show that those products could be used safely in construction, then passing the information along to the appropriate people to ensure that it was used to amend the codes and standards that regulate the industry."

Now, the lab is still involved in evaluating materials and systems, but it is doing more. Fire scientists led by Dr. David Yung have developed a predictive computer model called FiRECAMTM (Fire Risk Evaluation and Cost Assessment Model),

which allows people to ask questions that were never asked before, simply because there was no way to get answers.

FiRECAMTM makes it possible for design professionals to consider fire-safety systems as variables in a risk/cost equation, and to find rational answers to those tough questions. Thus, the cost of public fire services can now be considered as a variable in the fire equation. For example, which is the more cost-effective fire suppression in a new development: more sprinkler systems or more fire-fighters? The model uses extensive data and modelling on fire growth and spread, smoke movement, human behaviour and evacuation, and fire department response. Based on the fire protection design, the model calculates the expected risk to the lives of the occupants and the fire protection cost. Different designs might provide the same or better levels of protection, but at different costs.

Solving such puzzles is becoming more common as codes evolve into objective-based documents and builders look for ways to provide better buildings faster and cheaper, Mr. Richardson said, and tools like FiRECAMTM are essential to reaching rational solutions. ☼

Re: Energy Efficiency Retrofits (Solplan Review July 1997)

According to Mr. Mattes "strictly from an energy standpoint, high-performance windows are one of the worst investments than can be made." This comment reflects a fundamental flaw in analysing windows: he expects the energy savings from new windows to pay for new windows. Does he go into a car dealership and say, "I want to trade in my old car for a new car but I want the savings in fuel to pay for the new car"? Does he pay for a new house from the savings in energy relative to his old house? The point is that windows, like most other products, have a finite life. When the windows need to be replaced, I need to decide between windows that are similar to what I have now or high-performance windows. In this scenario, it is no contest: "high-performance windows are one of the best investments you can make." Not only does the energy savings pay for the incremental cost of the upgrade, but the house is more comfortable and condensation on the windows is virtually eliminated.

Stephen Carpenter
Enermodal Engineering Limited

Martin Mates replies: True, when your windows have failed and need replacement, buy new windows. But buying R3 versus R2.2 for a few thousand dollars more does not make economic sense according to the Audit2000. (The building scientists came up with the program, not me... I am just using it as a tool).

A home with proper ventilation will virtually eliminate moisture on most windows whether they are R1.5 or R3. Remember, same surface area, same air leakage (in some cases) not much of a difference. Remember, some high performance windows on the south side actually decrease overall solar gain so in effect may cost you money rather than save you money.

Martin Mattes, asks why people replace windows when they aren't cost effective? Energy cost effectiveness and keeping up with the Joneses are not the only criteria about which people care. We really need to give people more credit. In a cold climate single pane windows can be very UNCOMFORTABLE, and condensation on metal frame windows can be annoying.

If our energy programs had some comfort criteria, such as maintaining a mean radiant temperature over a certain level in rooms, I am sure you



Letters to
the Editor

Will Koroluk is an Ottawa freelance writer who specializes in building science.

would see window replacements higher on the list. In addition, as we all know, many windows leak substantial amounts of air, not only around rattling sashes but also around the rough openings and through pulley sash holes of double hung windows. But assessing the heat loss and comfort impact of this is difficult. Although windows are supposed to be near the neutral pressure plane, in any two storey house they are likely to contribute to discomfort and heat loss due to air infiltration. A house in a windy location can experience substantial air leakage through windows - just put an inside plastic storm window over even an apparently well sealed window and watch the plastic pump in and out from light breezes.

I am not familiar with brick construction in Canada but many homes in the USA have wood frame walls behind a brick facade. If so, why not consider blowing cellulose insulation into the frame wall behind the brick? (Again there are hard to quantify air leakage reduction benefits from adding this insulation.)

If there is no frame wall behind the brick did the author consider the cost effectiveness of an interior retrofit with 1" extruded Styrofoam or foil-covered isocyanurate as an option as outlined in the old Canadian Superinsulated Retrofit book of many years ago?

Finally the author seems to regret that the new furnace did not actually improve the efficiency of the

house (to which he is presumably referring to shell/envelope efficiency). One might think that increasing the efficiency of an envelope was an end in itself. I suspect most people care about comfort and cost. At least this consumer was economically rational!

Dave Brook
Oregon State University Extension Service
Portland, Oregon

Martin Mates replies: You missed my point. People buy windows for a variety of reasons. My article suggests that buying windows to save money does not make economic sense. Air sealing old existing windows is very cost effective. It is cheap and it works.

Audit 2000 models old windows with air leakage as a factor (in fact you can change it to what they would actually be . . . ie air testing). Old windows sealed correctly can still be comfortable in our Canadian climate.

Blowing cellulose behind brick is not only a violation of building code (9.20.6.4. (2) requires an air space behind the brick) but would also negate any rain screen principle and surely rot down the wall assembly.

Adding insulation to the inside requires re-drywalling the entire home. It was not cost effective over the short term.

Re: Reflective Insulation (Solplan Review July 1997)

I have on occasion been asked about these reflective insulation products. I would agree that generally the manufacturers have been misrepresenting the product. The user (or potential user) is generally unaware of the need for the furred air space. I advise that filling this 19 mm space with conventional insulation and using an air/vapour barrier of 6 mil poly would provide about the same R value gain and likely more economically.

I have also been asked about the direct application of gypsum board over these bubble pack foils. This is inappropriate as the R-value gain requires the furred space and the gypsum board should be in firm contact with the framing member. Installation over a soft support like these bubble packs would lead to joint movement and cracking.

I have seen these products in retail building supply stores and would agree the manufacturers' claims are misleading.

Brad Wing
Westroc Inc.

Long Term Abundance?

A note published by Centra Gas (the Gas utility on Vancouver Island) states "BC has an abundant natural gas resource. The provincial government has determined that the current reserves of natural gas are more than adequate to meet in-province demands and exports until 2011 . . ." I don't know about you, but my calculator tells me that's 14 years from now.

Just think about it. A child born today will just be entering high school when today's known gas reserves are used up. That's abundance?

"...In addition the established reserves, a further 50-80 year supply of natural gas is estimated to exist." The "estimates" are pure speculation that, unique to the oil industry, seem to be bankable.

Do you think the bank will give you money on your "estimate" that you will have an income based on building 200 houses per year 40 years from now?

Foundation Footing Forming System Connecting with uneven ground

There is a natural contradiction between products made by man and the surface ground. Excavated soil is never flat. Rocks get in the way and the excavating machine can't level the ground perfectly. To deal with this unevenness, foundation contractors spend a lot of time shovelling the high spots and filling in the low. This is always a very labour intensive activity.

The Fastfoot™ System has been developed to overcome the problems of tying together uneven ground and linear dimensional lumber. The system uses a fabric bag to contain the concrete for the footing. The fabric, being completely flexible, follows the contours of the ground when filled with the concrete. Imagine a long sock laid along the ground in the position of the footing. The top side of the sock is cut, and the two edges are stapled to two 2x6s, which are held in position by steel yokes. The yokes have telescoping legs to make levelling simple. An electric drill is used to raise and lower the legs until they line up with the laser beam. The concrete is then poured into the footing bag.

Compare this with conventional foundation forming methods. 2x6 or 2x8 ladders are built using 1x4 cross members. The 1x4s are wasted entirely. The other lumber has a waste factor of 15 to 25%. A lot of labour is spent to level the footing area, either by trimming or filling in the ground. Stakes must be driven into the ground to hold the footing at the proper height. Screeding of the concrete is difficult because of the 1x4s holding the edge lumber in position. Extra labour is needed to stripping the forms. In addition, as the concrete has poured around all the members, lumber dam-

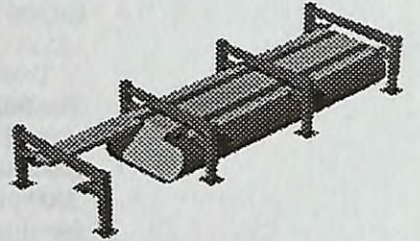
age is extensive as the concrete contaminates and warps the lumber.

As there are no 1x4s in the way, screeding of the concrete is very simple. Because the fabric is left in place, stripping of the forms is very simple. The yoke is split and the 2x6s are removed. The fabric protects the lumber from concrete damage. There is little concrete spillage on uneven ground.

The system is suitable for a wide range of wall systems and designs, as the width of the yokes is adjustable. This means that any footing dimensions required are easily achieved, which means that there is no problem with building codes and standards. Steel reinforcing is easily installed into the footing and stepped footings are achieved by stepping the yokes.

The developer of the Fastfoot™ system estimates that labour to construct footings is reduced by 60%, labour to strip footings is reduced by 80%, and consumption of forming lumber is reduced by 95%.

The system was developed by Maxito Industries Ltd., of Surrey, BC. The first fabric footing was installed in 1989. Since then, they have been exporting fabric footing systems into California for the seismic upgrading of modular buildings. More than 4000 footing bags a month are sold into this market. The system is intended to be used on a rental basis. It is available now in the Lower Mainland of BC. They hope to expand distribution nationwide. ☼



Forming bag in place
contains concrete for
the footing

For information:
Maxito Industries Ltd.
#300 - 14770 - 64Ave.
Surrey, BC V3S 1X7
Tel: 604-501-3060
Fax: 604-501-6090
e-mail: maxito@deepcove.com

New BC Building Code in 1998

A new BC Building Code will be introduced in the Spring of 1998, to come into effect during the summer of 1998. The new code is expected to follow very closely the latest ("1995") National Building Code of Canada. However, there will still be a few "made in BC" revisions. The major modifications from the National model code are expected to relate to items that presently have been incorporated in the current BC code, such as Letters of Professional Assurance, accessibility requirements and "unique provincial requirements" such as secondary suites.

Because the model national code is being proposed, there will be no open public review process

as in the past. (The National code itself undergoes a public review process).

Adoption of the National Building Code as the base document for BC will mean that BC's code will step back into conformity with the rest of the country. However, because of the administrative changes in the provincial government, there will be no local third party to interpret the Code, a function formally done by the recently closed Building Standards Branch. Presumably, the Canadian Codes Centre in Ottawa, developers of the model code, will be called on to do many of these functions. ☼

Energy Answers

Rob Dumont

How accurate are computer software programs for analyzing residential energy loads? Do you have to go to the high-end programs like DOE to get any accuracy?

Twelve years ago I wrote an article on this topic. The following is an update on that earlier piece.

As I was a co-developer of the HOTCAN program, which, many versions later, is now the HOT-2000 program, I can of course claim high accuracy for this program and disparage its competitors. Kidding aside, there are many user friendly (builder friendly) relatively inexpensive microcomputer programs developed by credible groups on the market.

I don't think that anyone in the residential housing field should go to the time and expense of learning a commercial building program like DOE. The extra information and potential accuracy gains would not be worth it.

Here are several reasons why all computer programs will not predict exactly the space heating requirement of houses.

1. Changing Weather

From year to year, the severity of the heating season can change dramatically. For instance, in Saskatoon our annual heating degree days average about 6000°C days. However, the annual numbers can change dramatically. Last year we had 6900°C days, or 15% more. In 1981 we had only 5050°C days, or 16% less than normal. No computer program can predict what the weather will be a year from now.

2. Occupant Behaviour

A second reason for possible discrepancies between a computer calculation and the actual consumption is occupant behaviour. Occupants can dramatically affect their space heating bills by changing the inside temperature, using a night setback thermostat, leaving windows open, etc. The use of natural gas for both space and water heating is common in Canada west of the Ottawa River. A larger family will likely use more hot water, and this will affect the total natural gas bill.

My favourite example of the effect of occupant behaviour on annual space heating bills was presented in a study done by Ken Cooper of SAR Engineering. Two adjacent apartments of identical size had a variation of 20 to 1 in their space heating consumption! The main reason for this tremendous difference was that one apartment was occupied by a family that liked a very warm environment. Their suite was 3.5°C warmer on

average than the adjacent suite. The two suites were separated by an uninsulated three storey high concrete block wall.

This 20 to 1 variation is unlikely to occur in occupied single family houses, but variations of two to one in the heating requirements of identical sized families in identical houses are not uncommon.

3. Equipment Setup and Maintenance.

We do a lot of energy auditing of buildings these days, and we notice a large variation in the combustion efficiency of furnaces and boilers. A well-tuned older natural draft furnace that is carefully installed can have low exhaust gas temperatures, low excess air in the exhaust, and a steady state efficiency of more than 80%. A poorly tuned furnace can be closer to 65%. These low efficiency values are often caused by insufficient air flow on the warm air side of the furnace. Sometimes, poorly maintained or never-maintained furnace filters can dramatically reduce the warm air flows on the furnaces, greatly reducing the air flow and the efficiency of the units.

4. Lights and Appliances Use.

In newer houses, the heat contribution from lights and appliances can be substantial compared with the space heating load. While some efficient households are running around 10 kilowatt-hours per day, many houses use double that amount of electricity for lights and appliances. A computer program cannot predict with precision what people will use for electricity.

While doing energy audits in an apartment building last month, we noticed that one apartment had quite high electricity bills. We put a clip-on wattmeter on the refrigerator. This older refrigerator was using about three times the amount of electricity of a properly operating unit. Likely the unit had lost most of its Freon, and was operating continuously trying to keep the food cold. The tenant had not noticed anything unusual.

5. GIGO

A final factor that could cause major differences between the computer's prediction and the actual numbers is the GIGO factor - Garbage In, Garbage Out. Some years ago I encountered a homeowner whose annual space heating bill was about \$400, while the computer had predicted about \$150. Upon examining his bills, I noticed three discrepancies in the computer program inputs. First, the computer printout said that the house had subfloor insulation in the basement. In fact, there was no

(Continued on page 17)

Wood I Joist Standard

Builders across North America increasingly are switching to engineered wood products and systems that offer cost-effective, high quality alternatives to traditional construction methods.

Wood I-joists are manufactured by a number of companies and each product varies a little from its competition. Differences may include flange widths, installation details, hole recommendations and materials used in the web and flange construction. Currently, builders and specifiers have to sort through a maze of I-joist manuals and manufacturer specifications to select the appropriate product for a given application. Then they must be certain that they obtain the product called for. This also means that as each is a unique system, the builder must supply an engineer's approval for each use - adding paper work and expense.

APA - The Engineered Wood Association has introduced a new performance standard (APA EWS PRI-400) for wood I-joists in residential floor applications. The performance standard is based on today's end-use requirements and is designed to ensure the overall performance of the floor structure. It will make the product easier to buy, specify and use.

The standard prescribes a performance criteria that all products must meet in order to qualify to become an APA Performance Rated I-joist. This means common load/span tables, installation instructions and engineering design values. Performance rated I-joists will ensure that no matter who manufactures the product, it will meet the standard requirements.

Span ratings will be stamped right on the product making it easier for builders to install them properly and more visible for code officials to inspect. The use of common span ratings for uniformly loaded applications for products manufactured by several

different manufacturers will reduce the time needed by design professionals to select and specify these products. This should in turn reduce the costs associated with using I-joists from different manufacturers having the same joist designation in the same floor system.

Standard installation details covered include end and interior bearing, framing for openings, transfer of concentrated loads, cantilever considerations and rimboard provisions. In addition, APA Performance Rated I-joists have standard hole charts developed from traditional tables that permit round or rectangular openings.

In general, this performance standard allows products to meet a certain end-use criteria without prescribing the manufacturing technology required to qualify the product.

The standard has been launched in the U.S. and has already been accepted by the Southern Building Code. Approval by the other model codes is expected soon.

It is not being marketed in Canada yet, as there are no Canadian wood-I joist manufacturers. As well, the APA has not yet formally approached the CCMC for review. The major shortcoming is that the vibration criteria are not entirely in conformance with Canadian standards. Once this is resolved, and Canadian suppliers have product, we should be seeing more reference to the standard, and it should be referenced in the next edition of the National Building Code of Canada. ☼

The objectives for developing the I-joist performance standard are clear:

- ☼ simplify specification and use
- ☼ create a level (performance) playing field
- ☼ lower costs
- ☼ assure product quality

Information:
APA Help Desk: Tel: 1-253-620-7400
<http://www.apawood.org>

Carbon Emissions Predicted to Climb 61%

According to the US Energy Information Administration world energy demand will rise more than 54% in the next 20 years.

By 2015 energy consumption in Asia should exceed energy consumption in all of North America. If development of China's transportation sector follows those in Thailand and South Korea (double-digit growth rate in automobile ownership), these forecasts could be "drastically underestimated."

If world energy consumption reaches the projected levels, carbon emissions by 2015 will be 61% higher than in 1990. By 2000, the carbon emissions in the non-industrialized world will exceed those in the industrialized nations and represent about two-thirds of the total increase in emissions worldwide.

If these projections are accurate, we are all going to be in trouble! Based on scientific projections, we had all better start studying the detailing used in hurricane country - as we will see more severe wind and storm action in all parts of Canada. Instead of a golfing holiday to Florida, it will be construction study tours!

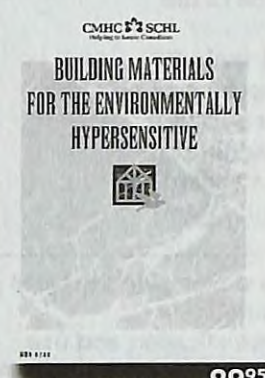
(Continued from page 16)

insulation. Second, the builder had used a night insulation scheme for the windows, but the true R value was nowhere near the R10 value used in the program. The biggest mistake was that the price used for energy in the program was no longer correct.

As may be seen, the prediction of the exact space heating requirement of a house is not a simple task. The good news is that for average occupancy conditions under average weather conditions the better programs will yield answers that should be correct to about plus or minus 15 percent. ☼

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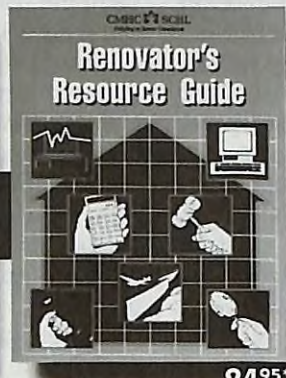
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Ontario R-2000 Program

Ontario Home Builders' Association will end delivery of the R-2000 Program in Ontario on January 31, 1998. OHBA "remains committed to the R-2000 program in principle" but does not have the resources to administer the program.

Natural Resources Canada is having discussions with several prospective partners and sponsors. They hope to be able to have alternate arrangements in place by January 31, 1998. Every effort is going to be made to a smooth transition so as not to disrupt builders' marketing programs. ☺

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Coming Events

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Tel: 604-432-7112 or 800-933-6777

October 19-20, 1997
CIPHEX '97 West
Edmonton, AB
Tel: 416-695-0447; Fax 416-695-0450

October 21-23, 1997
Security Canada Central '97
Toronto, ON
Alarm & security systems trade show & conference
Tel 905-513-0622

October 27-29, 1997
Sustainable Building Northwest Conference and Trade Show
a regional trade show and conference
Seattle, Washington
Tel: 206-842-8995 Fax: 206-842-8717
e-mail: obrien@halcyon.com
<http://pti.nw.dc.us/envcl.htm>

Nov. 5-8, 1997
EEBA Conference and Exposition
Denver, Colorado
Tel: 612-851-9940; Fax 612-851-9507
<http://www.eeba.org>

Jan. 14-15, 1998
Ontario Builder Forum '98
Toronto, ON
Tel: 416-447-0077; Fax 416-443-9982

February 8-11, 1998
CHBA National Conference
Hamilton, ON
Tel: 416-443-9023, Fax 416-391-2118

March 5 - 8, 1998
World Energy Efficiency Day and Trade Show
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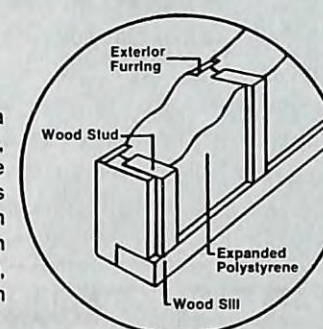
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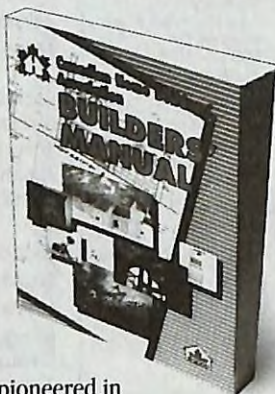
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